VOICE SWITCHING AND CONTROL SYSTEM (VSCS)

EMERGENCY ACCESS RADIO SYSTEM

(VEARS)

PERFORMANCE SPECIFICATION

FAA-E-2908

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REVISION: -

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

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FEDERAL AVIATION ADMINISTRATION

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APPENDICES

1. 0 SCOPE

This document lists requirements for the VSCS Emergency Access Radio System (VEARS).

1. 1 System Overview

The VEARS is intended to be installed in Voice Switching and Control System (VSCS) supported facilities that use M1 operator consoles. It shall provide EMERGENCY Air/Ground communication capability to primary sectors in case of catastrophic VSCS failure resulting in the loss of Air/Ground communications. One example of catastrophic failures of VSCS that could occur is failure of both the main and backup Air-To-Ground (A/G) VSCS switches during software upgrade. The VEARS will provide an independent path to primary radio remote control air to ground communication facility (RCAG) by interfacing to the Radio Control Equipment (RCE). It does not provide independent path to Backup Emergency Communications (BUEC). The VEARS will be powered from the facility critical bus and will not be operational in case of critical power bus failure. However, following a power restoration the VEARS shall be operational within 5 sec.

The functional requirements of the VSCS are specified in the VSCS Product Specification.

2. 0 APPLICABLE DOCUMENTS

The following specifications, standards, drawings listed in the various categories defined below form a part of this specification and are applicable to the extent described in this document.

2. 1 Government Documents

2. 1. 1 Federal Aviation Administration (FAA)

Specifications

FAA - G - 2100F	Electronic Equipment, General Requirements, Nov., 1993
FAA-E-2731F	VSCS Product Specification

Standards

FAA-STD-020a	FAA Standard, Transient Protection, Grounding, Bonding and Shielding Requirements for Equipment, September 1985

Other Publications

NAS-E-IC-42004205	FAA VSCS to Recording Equipment Interface Control Document
NAS-IC-42014000	FAA VSCS to Existing Radio Interface Control Document

Drawings

AUA-VEARS-3A1	Assembly, Single VEARS Module
AUA-VEARS-3A1M1	Chassis, Single Unit
AUA-VEARS-3A1M2	Panel, Front, Single Unit
AUA-VEARS- 3A1E1	Electrical Schematic Single VEARS Module
AUA-VEARS-3A2	Assembly, Dual Horizontal Module
AUA-VEARS- 3A2M1	Chassis, Dual Horizontal
AUA-VEARS- 3A2M2	Panel, Front Dual Horizontal
AUA-VEARS- 3A2E1	Electrical Schematic Dual VEARS Module (Horizontal)

AUA-VEARS- 3A3	Assembly, Dual Vertical Module
AUA-VEARS- 3A3M1	Chassis, Dual Vertical
AUA-VEARS- 3A3M2	Panel, Front, Dual Vertical
AUA-VEARS- 3A3E1	Electrical Schematic Dual VEARS Module (Vertical)
AUA-VEARS- 3A4	Assembly, Quad VEARS Module
AUA-VEARS- 3A4M1	Chassis, Quad Unit
AUA-VEARS- 3A4M2	Panel, Front, Quad Unit
AUA-VEARS- 3A4E1	Electrical Schematic Quad VEARS Module
AUA-VEARS- 3A5	Assembly, Quad Jack Box VEARS Module
AUA-VEARS- 3A5M1	Chassis, Quad Switch Box
AUA-VEARS- 3A5M2	Panel, Front, Quad Switch Box
AUA-VEARS- 3A5E1	Electrical Schematic Quad Switch Box Module
AUA-VEARS- 1A6	Assembly, Radio Control Adapter Card
AUA-VEARS- 1A6E1	Electrical Schematic, Radio Control Adapter Card
AUA-VEARS- 3M1	Insulator, Jack
AUA-VEARS- 3M2	Chassis, Side Cover, Horizontal
AUA-VEARS- 3M4	Chassis, Side cover, Vertical
AUA-VEARS-1A1	Rack Assembly

2. 1. 2 Military

MIL - STD - 129M	Marking for Shipping and Storage
MIL - STD - 2073	DOD Material, Procedures for Development and Application of Packaging Requirements

MIL - STD - 17555H	Electronic and Electrical Equipment, Accessories and Provisioned Items; Packaging of

2. 1. 3 Federal Standards

29 CFR 1910	OSHA Safety and Health Standards
FED - STD - 595	Colors used in Government Procurement

2. 2 Non-Government Documents

ANSI S3.25	Occluded Ear Simulator, ANS/ASA, 1979

3. 0 REQUIREMENTS

3. 1 Functional Requirements

The VEARS shall meet the following key requirements:

1. The VEARS shall be totally independent of the VSCS.

2. The VEARS shall provide direct communication connectivity between a VEARS equipped controller position and the air/ground radio equipment for the primary frequency(s) assigned to that position.

3. The VEARS shall be activated by a positive action of the controller. The only positive action that is permitted shall be the insertion of headset plug into the VEARS jack. VEARS shall be deactivated and the connection returned to the VSCS mode of operation within 5 sec., when the headset plug is removed from the VEARS jack.

4. The VEARS shall provide a push-to-talk (PTT) signal compatible with the PTT requirements of the interfacing primary radio system.

5. The VEARS shall provide an audio (transmit and receive) signal compatible with the audio requirements of the interfacing primary radio system (GRIM, Intelect C, RCE/ B or RCE/C).

6. The VEARS shall be capable of manual reassignment and connection of radios to positions (e.g., reconfigurable by patch panel).

7. The VEARS shall have an interface with the facility legal recording equipment so that any communication via VEARS at any radar position is recorded on the A/G communication legal recording channel at the radar position.

8. The VEARS shall provide paired VHF/UHF operation.

9. The VEARS shall be capable of selecting main/standby main/standby radios.

10. The VEARS shall have its own loudspeaker with a switch to route incoming audio.

11. The VEARS shall provide headset/handset and loudspeaker receive audio volume controls.

12. The VEARS shall have push to talk (PTT) lamp indicators.

13. Only during the time that the PTT is engaged for a radio frequency, the transmit audio will be enabled (to eliminate hot microphone problem). Also, when the PTT is engaged, the receive audio will be disabled.

14. The transmit audio shall be supplied to the recorder only when the PTT is engaged.

3. 2 Physical Design Requirements

The VEARS design shall contain only hardware components and shall not use any software or firmware.

The VEARS system shall include

a. VEARS Modules (Single, Dual, or Quad)

b. Patch Rack Assembly (housing Radio Control Adapter Cards)

c. Interconnecting Cables

d. Loudspeakers

The overall VEARS system design shall comply with the FAA-STD-020a.

3. 2. 1 The VEARS Modules

The VEARS modules shall house the components that a controller uses to interface to the A/G system. They shall provide main/standby selection with an indicator for both VHF/UHF transmitters and receivers, a push-to-talk indicator, and a receive volume control. The layout of VEARS modules shall be in accordance with the FAA drawings identified in Section 2.0. The modules must be activated to hear any audio from the speaker or headset/handset. Any future reference to headset in this document implies headset or handset.

3. 2. 1. 1 Single Module

The VEARS single module provides for access to one frequency pair per sector. It shall be designed to fit in a 6.75" high x 4" wide panel that will directly mount into the M-1 bezel when Harris VSCS M-1 console modifications are complete. The module shall be no more than 7.5 " deep.

3. 2. 1. 2 Dual Module

The dual module shall be designed to provide for dual diversity frequencies. The dual module shall have independent main/standby transmitter/receiver selection capability for the two frequencies. The PTT and headset audio shall be directed by an A/B switch control. When a PTT selection has been made with the A/B switch, the PTT for the other channel shall be cut off and the incoming audio is routed to the VEARS loudspeaker.

The dual module shall be built in two distinct configurations: Vertical and Horizontal. The panel space needed for the vertical configuration shall be 12" high x 4" wide, and the horizontal

configuration shall be 6.75" x 8" wide. Both configurations shall be no more than 7.5" deep. (The two configurations are required to accommodate dual modules in distinctly different console bezel modifications needed in the field).

3. 2. 1. 3 Quad Module

A quad or four channel module shall be designed to provide multiple frequencies with independent access to satisfy coverage in large airspace sectors. The quad shall have independent switches to select PTT, main/standby transmitters, main/standby receivers and receive audio. The receive audio can be directed to the position headset directed to the VEARS loudspeaker speaker, or turned off.

In order to be properly accommodated in M-1 consoles, the Quad module shall be built in two different sub-assemblies: switch control subassembly and headset panel sub-assembly. The switch control sub-assembly shall be 6.75" high x 16" wide. The headset panel sub-assembly shall be 6.75" high x 4" wide. Both sub-assemblies shall be no more than 7.5” deep. The layout shall be in accordance with FAA drawings identified in Section 2.0.

3. 2. 1. 4 Visual Indication

The PTT activation shall be indicated by a red light. When The VEARS loudspeaker is selected, the condition will be indicated by a yellow light. The selection of VHF or UHF main/ standby transmitter or receiver shall be indicated by corresponding indicator lights. The main/standby indicator light shall be yellow and green. All indicator lights shall be located on the face plate of the VEARS modules.

3. 2. 2 Patch Rack Assembly

This assembly shall house the radio control adapter cards and shall provide a centralized point for circuitry to interface with VEARS modules, legal recorders and the radio control equipment. In addition these racks will provide circuit patching capability. (These patch racks will be directly procured by the FAA.)

The patch rack assembly shall consist of two cabinets 22"x22"x84" bolted together. As viewed from the front of the assembly, the right side cabinet shall have a card cage which can house up to 120 Radio Control Adapter (RCA) printed circuit cards. A redundant 12V DC power supply shall be housed below the RCA card cage. A steel door with a window made of plastic shall enclose the right side. The window opening shall be designed to facilitate monitoring the status lights located on the front of the RCA cards and the power supplies.

The left side cabinet shall house the patch panels. These panels shall be capable of handling up to 120 channels for the VEARS. Patch cords shall be provided to enable any channel to be patched to any sector. A steel door shall be provided to protect the patch cables.

Two louvered doors shall be provided in the rear of the patch panel assembly to protect cable connections. The cable connections provided shall include connections to the RCE, the Radio Interface IDF, and the VDF.

(The patch rack assembly exclusive of the RCA cards will be directly procured by the FAA through the Northwest Mountain region Technical Support Services contract).

3. 2. 2. 1 Radio Control Adapter Cards

The radio control adapter cards shall consist of jack actuated transfer relays for radio control equipment and legal recorder connections, isolating relays and level controls. They shall be built as per FAA drawings identified in Section 2.0.

3. 2. 2. 2 Power

Two separate 120 V AC power feeds from the critical bus power at the facility are required to feed the VEARS power supply module housed in the patch rack. The VEARS power supply module input power shall be fed from two separate critical power 120V AC panel boards. The VSCS power panel boards shall not be used as the critical power source. The redundant 12 to 14 V DC output power from VEARS power supply module shall be combined to allow either or both power supplies to power the RCA cards. Failure of one DC power supply shall not disrupt the functioning of the RCA cards. The power supply output rating shall be 750 to 1000W. No convenience power outlets shall be provided in the racks.

3. 2. 2. 3 Grounding

The rack structure shall be grounded in accordance with the National Electric Code (NEC) requirements for equipment racks. The facility Multipoint Ground shall be tied to the rack ground stud.

3. 2. 2. 4 Seismic Protection

The patch racks at various sites shall be secured to withstand the local seismic conditions.

3. 2. 3 Loudspeakers

Each M1-Position shall have an ancillary loudspeaker for the VEARS system. The speaker selected shall have built-in amplifier and volume control and shall meet the following specifications:

Dimensions: 6.75" High X 5.00" Wide
Amplifier Input Impedance: 600 to 1000 ohms
Amplifier Input Level: -15 dBm (0.1 VRMS) to +10 dBm (2.4 VRMS)
Amplifier Rated Power Output: 1Watt (RMS)
Operating Voltage: 24 VDC Nominal
Sound Pressure Level : 95 dB
(@ 1 meter, @1W, @1 kHz)

3. 3 Performance Requirements

The VEARS sub-assemblies/LRUs shall be aligned and tested to verify compliance with performance requirements in this section.

3. 3. 1. General

Selection of a radio frequency channel shall be accomplished by inserting the headset plug into the VEARS jack. While the channel is selected, the position shall receive all audio transmissions occurring on that channel. Transmission on selected RF channel shall be accomplished by pressing and holding PTT switch for that position. A path for transmit audio shall be established from the position to the corresponding radio interface for that frequency until the PTT switch is released. Channel deselecting shall be accomplished by removing the jack from the VEARS jack.

3. 3. 2 Impedance

The VEARS shall be designed to interface with radio circuit with impedance in the range of 600 ohms, +/- 20%. The transmit impedance at the VEARS end shall be 600 ohms, +/- 10 % isolated from ground.

3. 3. 3 Audio Transmit and Receive Levels

The VEARS shall be designed to provide transmit audio levels of -5 dBm +/- 6 dB when the input level at the VEARS jack is -9 dBm; the design shall incorporate a limiter which will prevent the transmit level from rising more than 3 dB above the nominal transmit level when the input level rises to +3 dBm (this limiter is specified to accommodate the headset and handset transmit level incompatibility that has been observed at the ARTCCs). The VEARS shall operate with receive audio levels in the range of -52 dBm to -2 dBm without harmonic distortion greater than that defined by paragraph 3.3.9. The VEARS shall be designed such that a receive audio level of -17 dBm at the external radio interface shall produce a nominal headset audio level of -25 dBm.

3. 3. 4 Sidetone

The VEARS shall provide audio sidetone at the VEARS jack for all VEARS communications emanating from the position. This sidetone generated shall be such that the headset volume control set to nominal and with a test tone of 1004 Hz at a level of -9 dBm injected into transmit path of the VEARS jack, the level measured at the receive path of the position jack shall be -25 dBm +/- 1.5 dB. This sidetone shall be adjustable via an independent volume control provided in the radio control adapter card. A minimum of 5 levels of adjustment from 0 dB to a minimum level of at least -12 dB shall be provided in increments no greater than 3 dB. The volume control for sidetone shall be independent from all other volume controls. The sidetone shall be provided through the headset or handset and shall not be audible through the position VEARS loudspeaker.

3. 3. 5 Background Noise

Combined hum and noise level of any single voice path measured at the VEARS jack with the headset volume control set to nominal, or at the voice path interfaces with external equipment,

with both ends of the path properly terminated, shall not exceed 20 dBrnC for the C-message weighted noise.

The VEARS shall exhibit unweighted background hum and noise over the voice band (300 - 3000 Hz), of no more than 39dBrn, measured at any output.

3. 3. 6 Frequency Response

The frequency response over the frequency range from 300 to 3000 Hz shall not vary by more than +/- 3 dB of the value measured at 1000 Hz. Roll off rate at frequencies below 300 and above 3000 Hz shall be a minimum 6 dB per Octave (20 dB per decade).

3. 3. 7 Crosstalk Between Channels

The crosstalk coupling loss shall be greater than 50 dB between any transmit or receive path voice frequency circuit.

3. 3. 8 Idle Channel Noise

With the input terminated in the nominal impedance, noise measured at the output shall not exceed 30 dBrnC0.

3. 3. 9 Harmonic Distortion

The total harmonic distortion in a voice circuit produced by the second and third harmonics of 1004-Hz test tone at -9 dBm when injected at a VEARS transmit jack or -17 dBm when injected at a receive audio path interface with external equipment shall be at least 20 dB below the test tone at the point of measurement.

3. 4 System Characteristics

3. 4. 1 VEARS Module Power

The VEARS modules which house the components that a controller uses to interface to the A/G system shall receive their needed power from the patch rack power supply.

3. 4. 2 VEARS Loudspeaker Power

Each loudspeaker assembly shall be supplied with 24VDC from a 24 VDC power supply connected to a 120 V, 60 Hz, AC source. The power supply selected shall be capable of powering up to 10 VEARS loudspeakers.

3. 4. 3 Legal Voice Recording

The VEARS system shall be designed to record all communications facilitated by the VEARS on the same channel of the Government furnished legal recorder as the corresponding VSCS communications of that position.

3. 4. 3. 1 Impedance

For the legal recorder interface, VEARS shall operate with a sink impedance of 600 ohms, +/- 20 percent.

3. 4. 3. 2 Recorder Audio Levels

When a -9 dBm, 1004 Hz test tone is injected at the VEARS transmit jack, the recorder interface shall deliver -10 dBm, +/- 1.5 dB into a 600 ohms impedance representing the legal recorder input impedance.

The VEARS shall be capable of providing receive audio levels of -10 dBm +/-1.5 to the recorder interface when a nominal input level of -17 dBm is injected in the receive path. Record audio levels shall not be affected by the operator's volume control and shall be recorded at the relative levels present at the output of the RCA card.

3. 4. 3. 3 Frequency Response

The frequency response shall not vary more than 4 dB over the frequency range from 300 to 3000 Hz. The roll-off rate at frequencies below 300 Hz and above 3000 Hz shall be a minimum of 6 dB per octave.

3. 4. 4 VEARS Headset/Handset/PTT Jack

The jack power and jack module shall be compatible with headset/handset currently being used by the FAA at the ARTCCs. The jack shall be supplied with its own operator volume control capable of adjusting the audio output level over a range of +0 dB, -32 dB of the nominal level. Signal limiting capability shall be provided such that no signal 8 dB greater than the nominal shall be allowed to the headset, regardless of the operator volume control setting. The nominal headset level as discussed in 3.3.3 is -25 dBm.

The Plantronics model SHS-1597 is an example of the headset which has similar characteristics as those that are currently being used at the ARTCCs. Their basic characteristics are given below.

3. 4. 4. 1 Transmit Electrical Characteristics

Output Level : -22.5 +/- 4 dBV (47.3 - 119 mVRMS) across 50 ohms for an input of 94 dB Sound Pressure Level (SPL) with 118 mAdc present.

Impedance : 47.5 ohms +/- 22.5 ohms

3. 4. 4. 2 Receive Electrical Characteristics

Output Level : 76.5 +/- 4 dB SPL into a Brüel and Kjaer Model number 4157 ear simulator (ref. ANSI S3.25 - 1979) through a tube of 3.625L x 0.046ID connected to a Brüel and Kjaer DP 0370 earplug simulator for an open-circuit input of 12.6 mVRMS through 600 ohms.

Input Impedance : 600 ohms, nominal

3. 5 External Interfaces

The VEARS shall provide external interfaces for the A/G frequencies that have been identified at each position for VSCS independent path during any catastrophic failure of the VSCS. The VEARS radio interface characteristics shall be consistent with those identified in the VSCS to Existing Radio Interface Control Document. The VEARS legal recording interface characteristics shall be consistent with the VSCS to Recording Equipment Interface Control Document.

3. 6 System Design and Construction

3. 6. 1 Hardware

The VEARS modules and the Radio Control Adapter Cards shall be fabricated, packaged and integrated in accordance with design drawings, subassembly and parts selection provided by the FAA.

3. 6. 2 Surface Finish

All VEARS equipment shall be painted with baked enamel paint. The color of the VEARS module panels shall be FAA tan (brown mat texture, FED-STD-595, Colors Used in Government Procurement, Color #30372) and any lettering on the panel shall be in black. The headset jack shall have a 1/4 inch border in Dayglo Orange or red around it.

3. 6. 3 Wiring and Cables

The VEARS shall be furnished with all cables required for factory acceptance testing. The production model Quad modules shall be supplied with the interconnecting cable between the switch module and the and the headset jack module.

3. 6. 4 Mechanical Design and Manufacture

The mechanical design and manufacture of the VEARS equipment shall comply with the following requirements of FAA-G-2100F:

Printed Circuit Boards	3.2.2.1.3 ; 3.3.1.3.4.16 (Printed Wiring Board modification and conformal coating of printed circuit board, as discussed in 3.3.1.3.4.16.3 and 3.3.1.3.4.16.4, are not required)
Assembly Requirements	3.2.2.1.4 ; 3.3.1.3.5.3
Reference Designations	3.2.2.4
Nameplates and Marking	3.3.3 (Markings on Wafer Switches as discussed in section 3.3.3.2.6 is not a requirement. The nameplate design and marking shall be in accordance with the guidance provided by the FAA Program Manager during technical interchange meetings with the contractor. No other formal request for guidance by the contractor on the subject of nameplates and markings is needed).
Workmanship	3.3.4
Insulating Materials, Elect	3.3.1.1.7
Excess Conductor Wire	3.3.1.2.5.2
Strain Relief	3.3.1.2.5.3
Equipment Finish	3.3.1.2.6
Wiring	3.3.1.3.4.26 (Point to point connector contact wiring for cables as discussed in 3.3.1.3.4.26.17 is not a requirement)

3. 6. 5 Design Details

The contractor shall provide with the design documents the anticipated heat that will be dissipated by each type of VEARS module and the RCA card. The contractor shall also provide approximate weight of each type of VEARS module and the RCA card.

3. 6. 6 Level Adjustment Accessibility

The transmit and receive audio levels shall be adjustable from the front panel on the RCA card. The recorder and sidetone audio levels shall be adjustable but not from the front panel.

3. 7 Reliability, Maintainability, and Service Life

3. 7. 1 Reliability

a) The VEARS, in any size or configuration, shall exhibit a mean time between critical failures (i.e., failures leading to the full or partial inhibition of transmission or receipt of communications at any position because of faults within the VEARS) of not less than 8000 VEARS operational hours.

b) In no case shall the failure of any single component of the VEARS prevent the use of more than one A/G frequency or position.

3. 7. 2 Maintainability

a) Excluding administrative and logistical time, the VEARS shall exhibit a mean time to repair of not more than 30 minutes for any single maintenance action, including time required for fault localizing, LRU replacement, test, and restoration to service.

b) Excluding administrative and logistical time, the VEARS shall not require more than 90 minutes for any single field repair action, including time required for fault localizing, repair, test, and restoration to service.

c) Any maintenance action at any one position shall not prevent the use of VEARS at other positions.

d) No VEARS maintenance action shall require the VSCS to be shut down.

3. 7. 2. 1 Preventive Maintenance

a) The minimum interval for preventive maintenance of the VEARS shall not be less than three months.

b) Preventive maintenance shall not require service interruption on more than one position or external interface at a time.

c) Excluding administrative and logistical time, preventive maintenance of VEARS at a facility shall not require more than 1 hour per position per visit, including no more than 30 minutes of downtime per position per visit.

3. 7. 2. 2 Labor Requirements

No VEARS maintenance action shall require the simultaneous labor of more than two persons.

3. 7. 2. 3 Replacement of Consumable or High-wear Components

The VEARS will not require interruption of service or disordering for the replacement of components that are by design consumable or subject to high failure rate (e.g., light bulbs).

3. 7. 3 Service Life

a) The VEARS shall permit continuous, round-the-clock use.

b) When properly maintained in accordance with this specification, the VEARS shall continue to meet the functional and performance requirements of this specification continuously throughout a service life of at least 5 years of continuous use.

3. 8 Configuration Management

All hardware configuration items shall have unique identification markings acceptable to the FAA.

3. 9 Logistics Support

3. 9. 1 Parts List

The contractor shall provide a list of all Line Replaceable Units (LRUs), parts and assemblies in accordance with the approved system configuration.

3. 10 Safety

VEARS design shall comply with system safety engineering principles in accordance with 3.3.6 of FAA-G-2100F and the OSHA Safety and Health Standards.

3. 11 Environmental Endurance

3. 11. 1 Operating Environment

The VEARS shall suffer no degradation in performance when operated within the following conditions, and under all fixed and slowly-varying conditions of voltage defined in 3.2.1.3 of FAA-G-2100:

Operational Temperature Range: 10° to 40° C

Relative Humidity: 10% to 80% non-condensing

Altitude: Up to 6000 feet above sea level.

3. 11. 2 Non-Operating Environment

The VEARS shall suffer no damage when stored, transported, or left idle (without power) under the following conditions:

Temperature Range: - 40° to 70° C

Relative Humidity: 0% to 100% including condensation

Altitude: 0 to 35,000

3. 11. 3 Electromagnetic Compatibility

The VEARS shall not cause electromagnetic interference with or be affected by electromagnetic interference at sites where they are installed. Specifically, VEARS operation shall not be affected by the presence of external electrical field of up to 1 volt/meter over the range of 14 kHz to 18 GHz. Also, the electromagnetic emission radiated from operational VEARS shall not exceed 55 dB microvolt/meter in the frequency range of 14 kHz to 1 GHz.

4. 0 VERIFICATION REQUIREMENTS

4. 1 Responsibilities for Verification

Compliance with each section 3 requirement my be verified at one or more of the following test phases discussed in this section.

4. 1. 1 First Article Testing

As a necessary condition for further production, the first VEARS produced shall pass first article testing and evaluation against all requirements of this specification.

4. 1. 1. 1 Environmental Qualification Tests

Environmental qualification tests shall include those relating to vibration, thermal/vacuum, and electromagnetic compatibility. Tests approved by MIL standards are deemed acceptable for this purpose. The tests conducted on pre-production units shall include the following:

a. The pre-production units shall be vibration tested using a two axis 6 G random wave profile for a duration of 5 minutes to verify the ability of the VEARS units to withstand earthquake shock.

b. The pre-production units shall be subjected to environmental stress testing using standard non-operating profile of 24 cycles of 2 hour duration, one hour cold and one hour hot including transition time, cycling from +55°C to -40°C.

c. The pre-production units shall be EMI tested to verify that the design meets FAA requirements specified in 3.11.3.

d. Following the above tests the pre-production units shall be retested to verify functionality. Any failure of functionality tests shall be diagnosed to determine the source of failure and appropriate corrective actions shall be taken. Following the corrective actions, if the pre-production units deviates significantly from the production units, tests outlined above shall be performed on the initial production to verify that the VEARS assemblies remain in compliance with FAA requirements.

4. 1. 2 Production Testing

Twenty percent of all VEARS units shall undergo an initial operational test to verify functionality. After that these units shall be subjected environmental stress screening tests. As part of these tests the units shall be subjected to 24 cycles of 2 hour duration, one hour cold and one hour hot including transition time, cycling from +55°C to -40°C. The purpose of this testing is to provide an accelerated life cycle parameter to screen components susceptible to infant mortality.

Following this cycling, the units shall be retested to verify functionality. All failures shall be tracked using standard statistical process control methods. These reports shall be used in the life cycle analysis for logistics support and for updating the mean-time between failure analysis study.

4. 1. 3 Technical Field Test and Evaluation

The VEARS shall undergo technical field testing and evaluation at the FAATC conducted by the FAA to ensure that VEARS will operate in accordance with pertinent National Airspace System (NAS) system-level functional, performance, and interface requirements when configured and integrated into its operational environment. This testing and evaluation shall be done prior to ordering production units.

4. 2 Verification Methods

Compliance with each requirement of this specification shall be verified by one or more of the following methods:

a) Test, in which quantitative measurements are taken of system response to pre-defined stimuli. These measurements are taken with standard laboratory equipment (e.g., voltmeter) according to scenarios identified in the contractor documentation and are then analyzed to ascertain compliance with requirements (e.g., measuring console equipment cutout size).

b) Demonstration, in which qualitative observations are made of system behavior in response to pre-defined stimuli. The observers (who may or may not require specialized training or experience) will report whether or not the system complies with requirements.

c) Inspection, in which the system is visually examined by observers (who may or may not require specialized training or experience) who will report whether or not the system complies with requirements (e.g., inspecting parts for proper manufacturing procedures; inspecting the system to verify that it can support the required number of positions).

d) Analysis, in which the system is modeled mathematically according to accepted techniques by analysts who will ascertain compliance based on the results of their computations (e.g., estimation of system reliability from part failure rate data).

4. 3 Specialized Verification Requirements

The following paragraphs describe specialized verification procedures for certain requirements of the specification.

4. 3. 1 System Maintainability Demonstration

A maintainability demonstration shall be conducted on the VEARS by the FAA to verify compliance with the maintainability requirements of this specification.

5. 0 PREPARATION FOR DELIVERY

The contractor shall comply with the requirements of the Military standards identified in Section 2. 1. 2.

APPENDIX A: ACRONYMS

A/G	Air/Ground
ARTCC	Air Route Traffic Control Center
ATR	Air Traffic Plans and Requirement Service
BUEC	Backup Emergency Communications
dB	Decibel
DS-RCE	Down Scoped - Radio Control Equipment
FAA	Federal Aviation Administration
FAATC	FAA Technical Center
Hz	Hertz
IDF	Intermediate Distribution Frame
LRU	Line Replaceable Module
M/S	Main/Standby
NAS	National Airspace System
PTT	Push To Talk
RCA	Radio Control Adapter
RCAG	Remote Center A/G Communications Facility
RCE	Radio Control Equipment
TLP	Transmission Level Point
TRACON	Terminal Radar Approach Control Facility
TSSC	Technical Support Services Contract
UHF	Ultra High Frequency
VDF	VSCS Distribution Frame
VEARS	VSCS Emergency Access Radio System
VHF	Very High Frequency
VSCS	Voice Switching and Control System

APPENDIX B: DEFINITIONS AND TERMS

Assigned Frequency - A frequency in an air traffic control position map made available for use at a position. Frequency assignment implies only the availability of the transmitter and receiver to the position.

Background Noise - Noise level present on a connected voice circuit.

Catastrophic Failure - Failure that is both sudden and complete.

Channel - A communication path providing one-way or two-way transmission between two terminations.

M1 Console - A standardized, human -engineered equipment cabinet including a work surface with provision for physical devices including: main display, interactive display, data entry keyboard, keypad, communications jacks, loudspeakers, and VSCS panel. Various configurations of physical devices provide for air traffic control and ancillary activities.

dbm - A logarithmic measure of a power with respect to a reference power of one milliwatt.

dbm = (10) log (P/0.001 Watts)

dbm0 - A logarithmic measure of power (in dbm) at the 0TLP to produce the same power in dBm at another point in the circuit using 1.0-kHz tone.

dBmC0 - The test tone 1000 - Hz power level measured at the 0TLP using a "C" message weighting network.

dBrn - A logarithmic measure of power with respect to a reference power of one picowatt (-90 dBm), used for noise tests.

dBrnC - A logarithmic measure of power relative to a noise reference of -90 dBm as measured with a noise meter weighted by a special frequency function called C - Message Weighting. The interfacing effect of noise given in dB above a noise reference of - 90 dBm at 1.0kHz measured with a C-message filter.

dBrnC0 - Noise measured in dBrnC referred to the 0TLP.

Deselection - Causing the state of a selected feature of the VEARS to change to not selected.

Frequency - A part of the radio spectrum used by the FAA to carry communications between controllers and pilots. The spectrum contains ultra-high (used for military air traffic) and very high frequencies (used for civilian traffic).

Frequency Pair - A combination of VHF and UHF frequencies used as a single radio communication channel.

Guard Frequency - A designated point in the radio spectrum to which radio equipment is kept tuned expressly to monitor for and to make emergency broadcasts. The FAA uses 121.50 MHz and 243.0 MHz as guard frequencies.

Idle Channel Noise - Noise level present on an unconnected voice circuit.

Intermediate Distribution Frame - A distributing frame used to terminate in-house cabling.

Line Replaceable Unit (LRU) - Any system item that is replaceable at the organizational maintenance level without using any special tool.

Push-to-Talk (PTT) - A method of communication over a speech channel in which transmission occurs in only one direction at a time; while talking, the talker is required to keep a switch activated (continuous touch action).

Sidetone - The acoustic signal resulting from a portion of the transmitted signal being coupled to the receiver.